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ABSTRACT

This report is the result of the First Annual Forum of the National Institute for Science Education (NISE) held in Rosslyn, Virginia, on March 18-19, 1997. The purposes of the forum were to make relevant professional audiences aware of NISE work and, just as importantly, to gain those audiences' perspectives on and participation in NISE work. Professional development is explored as one of the vital issues in mathematics and science reform. This report contains the content, process, and discussions of the following elements of the forum: (1) a framework for the design of science and mathematics education professional development currently being developed by the NISE Professional Development team; (2) cases of professional development; (3) the Forum itself as an application of the design framework; and (4) building and supporting a science and mathematics education professional development learning community. (Author/KHR)

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National Institute for Science Education

University of Wisconsin-Madison. National Center for Improving Science Education

Workshop Report No. 3

Professional Development for Science and Mathematics Education: Putting Knowledge into Action

A Synopsis of the First Annual Forum of the National Institute for Science Education

Peter Hewson and Susan Loucks-Horsley

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Professional Development for Science and Mathematics Education: Putting Knowledge into Action

A Synopsis of the First Annual Forum of the National Institute for Science Education

Peter Hewson and Susan Loucks-Horsley

National Institute for Science Education
University of Wisconsin-Madison

April 1997

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Introduction

This synopsis is the result of the First Annual Forum of the National Institute for Science Education (NISE) held in Rosslyn, Virginia, on March 18-19, 1996. The Forum's purposes are to make relevant professional audiences aware of the NISE work and, just as importantly, to gain those audiences' perspectives on and participation in NISE work.

At the First Annual Forum, 235 people gathered to explore a vital issue in mathematics and science reform-professional development-and to discuss the topics under study at the new National Institute for Science Education. This synopsis includes the content, process, and discussions of the professional development component of the Forum.

The Forum's primary purposes were to (1) extend and strengthen understanding of practices and issues in professional development and implications for design of more effective programs and initiatives in mathematics and science education and (2) build a learning community of those seeking ongoing interaction around professional development practices and issues. A secondary purpose was to design a conference that modeled many of the principles of effective professional development.

This synopsis includes a discussion of the following elements of the Forum:

- a framework for design of science and mathematics education professional development currently being developed by the NISE Professional Development team,
- cases of professional development,
- critical issues in professional development,
- the Forum itself as an application of the design framework, and
- building and supporting a science and mathematics education professional development learning community.

A Framework for Design of Professional Development for Science and Mathematics Education

Embedded throughout the Forum was the premise that discussions of professional development, to both move theory forward as well as best inform decision making, need to focus on design of learning experiences, not on particular models. Each situation is unique and demands its own special combination of strategies and structures tailored to its goals and audience.

A design framework presented by the Professional Development team at the beginning of the Forum was further elaborated during commentaries and discussions. Key elements of professional development design emerged as (1) a purpose, problem to solve, or set of needs to address in a given situation; (2) a set of guiding principles, knowledge, and beliefs about what should characterize effective professional learning experiences for science and mathematics teachers; (3) strategies, structures, and technologies that can be used to facilitate learning; and (4)

capacities to implement and sustain new ideas, approaches, and a culture of continual improvement-capacities embodied in people and a supportive infrastructure.

The discussion of design of professional development programs and initiatives was enhanced by two items: (1) a synthesis of standards for professional development created by analyzing those of the National Council of Teachers of Mathematics, National Research Council, and National Staff Development Council that pointed out a remarkable consensus by largely separate educational communities about what constitutes effective professional development for mathematics and science teachers and (2) an articulated set of strategies and structures for professional development that has been discerned in both literature and practice to constitute a set of choices for design of professional learning experiences.

Principles of design and the idea of a design framework proved to be useful tools for thought and discussion, as presenters on professional development shared their thinking about why they made the decisions they made, how their particular context influenced their choices of strategies and structures for professional development, what decisions they now face, and what design dilemmas these represent. As discussions focused increasingly on design, comparisons could be made between such professional development strategies as curriculum development, immersion in inquiry, and training in a set of curriculum materials. Discussions of trade-offs and the "craftspersonship" required to integrate these strategies were rich and engaging. The idea of feedback loops, critically important to effective design, is one that needs to be explored and made more integral to this process.

To paraphrase one Forum participant: I came looking for specific ideas about what to do in my district science program. I found myself frustrated when pushed first to consider the general approaches of training teachers in kits, contrasted to introducing them directly to the theory and practice of inquiry. Now I understand how important it is to integrate the two in ways that help our teachers to change their teaching and that build the capacity of our teacher leaders to make change happen.

Two especially interesting themes emerged from our discussions of science and mathematics professional development design. One involved the influence of context and culture on the success, sustainability, and application of professional learning. To elaborate, often teachers are blocked from using what they learn and unmotivated to learn more because of lack of support and of a supportive culture in their schools. The question of support raises the issue of the boundaries of professional development: Does paying attention to the context and culture as we design professional development opportunities mean we need to work also to change that culture (in which case our work is far larger and more challenging, and we are generally less knowledgeable about how to succeed)? Or is it more simply to acknowledge the existing culture and try to tailor professional development to it?

The second theme involves building capacity to implement and sustain changes in teaching and learning science and mathematics: what capacity building means, how to do it through teacher leadership development, what constitutes a strong, sustaining infrastructure, and what capacity building implies for professional development designs. These two themes were repeated

throughout case and critical issue discussions and have major implications for a design framework as well as for the work of design.

The design framework showed its utility in the Forum and will be further elaborated as a tool for examining, classifying, and critiquing professional development strategies and approaches for mathematics and science teachers.

Insights from Cases of Mathematics and Science Professional Development Programs and Initiatives

A significant proportion of time at the Forum was devoted to case discussions for several related reasons. The first, a commitment of the Professional Development team, is that any discussion of professional development needs to be rooted in practical reality, the experience of those who are doing it. Without this base in reality, discussions of professional development can too easily be dismissed as academic theorizing. The second is a related reason: in considering the practical experiences of other professional developers, participants would be better able to make connections to their own practice, thereby facilitating their own reflection. The third reason is that, by considering several different cases, participants would be able to compare and contrast them, a process that leads to a deeper awareness of the important issues in professional development. The final reason follows from the first: The concept of professional development as design presented at the Forum grew out of the team's discussions of different cases, strongly suggesting that the concept could only take on meaning for Forum participants when rooted in case discussions.

Drawing from accounts given by many different people including participants, case presenters, team members, and NISE evaluators, a number of observations can be made.

- The character of the discussions changed over the course of the meeting. We seemed to move from a focus on the case details (What did you do? Why did you do it?) to a consideration of more general issues. Being part of discussions about a range of different cases was an important factor in the change in discourse.
- The explicit focus that case presenters gave to outlining dilemmas they faced, rather than offering their cases as successful completed products, was welcomed by most. Many participants appreciated the openness of presenters in putting themselves "on the line" with a group with whom they were not necessarily familiar. Some presenters felt that, even so, there was some unwillingness to offer critiques of a case, perhaps because participants felt these would be construed as personal attacks. In any event, the focus on dilemmas encouraged discourse of a problem-solving nature.
- There were indications that participants were seeing commonalties across cases. To illustrate, some participants began to see similarities between dilemmas occurring in different contexts.
- Virtually all of the reporters spoke of the design framework being central to understanding what happened in the case discussions. On the other hand, there seemed to be very little conversation in most of the case discussions that was specifically about the concept of design and the design framework presented in the opening plenary session.

The contrast between different people's perceptions of the extent to which the concept of design entered the case discussion may seem paradoxical. The observations above carry a possible explanation of the paradox. When people move beyond asking questions about what happened in a case and for what reasons to working on the solution of a dilemma, they are starting to ask about the context in which the case is set, about the beliefs that support it, about the strategies that one might consider in addressing the dilemma, and about how all these different aspects interact with one another. In other words, in engaging in this type of conversation, we became involved in design issues; we moved into design-in-action in which participants are not thinking about the process of design, but doing it. In this respect the value of focusing on dilemmas becomes more apparent: because there was an unresolved issue, there needed to be a critique of what was involved, what the options were, which were preferable and why, and what choices should be made. These matters, among others, need to be considered in the process of design.

What typically did not happen in the case discussions was explicit reference to the design framework presented in the opening plenary or, more generally, to the process of design. Using the framework to carry out (or even start) an explicit analysis of the case studies didn't happen. There was an awareness on the part of case presenters and participants that design was an important issue, but, except for a few occasions, it remained below the surface as a powerful undercurrent.

Critical Issues in Professional Development

The nine critical issues discussed at the Forum had been identified by the Professional Development team and Fellows as being common to a wide variety of professional development initiatives and important to their success. In this section we try to capture the essence of the discussions held during each of the sessions. There was a sense that, by sharing ideas and concerns, everyone came a little closer to recognizing solutions. Many participants noted that, because of the sharing within these critical issues sessions, they are ready for further discussions of additional solutions and strategies. These discussions will be the focus of future interactions of the "learning community."

Roles of Scientists and Mathematicians

Participants agreed that professional development would be better if scientists and mathematicians were involved; they could share their content expertise and, in doing so, share a responsibility for professional development. Those who do become involved need to be able to communicate effectively with teachers and to respect and understand the problems that students and teachers face in learning mathematics and science concepts.

- a large content knowledge base,
- their way of thinking (the scientific or mathematics culture),
- real-life applications,
- modeling inquiry as it is actually done,

- integration of scientific fields,
- showing that science and mathematics are fun, but still science and mathematics, and
- opportunities to participate in authentic science or mathematics experiences, with teachers, students, and scientists or mathematicians working together.

The group also noted that scientists and mathematicians can benefit from their involvement with educators by their exposure to children and by becoming advocates for education. By doing so, they would recognize the need for continued exposure to education research, including how children learn and at what cognitive level, constructivism, and teaching and learning research. Collaborative work involving mathematicians and scientists with education researchers is a top priority for all of the work at NISE.

Teacher Professionalism

Participants dealt with questions about ways to develop teacher professionalism.

- How do we encourage teachers to see themselves as professionals?
- How do we create a professional environment that fosters teachers feeling this way?
- What message do we send by preaching about teacher professionalism but not changing the structures (time, empowerment to make decisions, release from the classroom, etc.)?
- Those who set up professional development in mathematics and science have a different task from those designing professional development in other areas such as language arts. Teachers come to other content areas with a working knowledge of the content-they sometimes don't have that working knowledge in mathematics and science, especially at elementary and middle grades. How do we provide professional development opportunities in mathematics and science that avoid demeaning the teachers?

These questions raised two concerns for the participants: What are the circumstances and attitudes that mitigate against teachers feeling and acting like professionals? How do we take advantage of the dispositions that are common among teachers (such as commitment to what they do) that support a sense of professionalism? The group described some of the circumstances that contribute to teachers' development of a sense of professionalism.

- Teachers participate in the governance of schools, particularly having input into how resources are distributed.
- Teachers have access to resources separate from their school.
- Teachers are researchers in their own classrooms.
- Teachers have the opportunity to share the results of their research.
- Professional development provides opportunity and structure, allowing the teachers to provide the questions and the content.

Concerning the last, participants discussed the responsibility of providers to offer more than simply a structure. The group agreed that professional development is more complex than simply bringing teachers together but felt that providing opportunities for formal-and informal—collaboration among teachers was an important step toward creating a sense of professionalism.

Leadership

Participants' concerns around leadership seemed to fall into two categories: (1) a concern that teachers leaving enhancement programs could provide leadership to help others use the ideas, materials, teaching strategies, etc., that they had learned; (2) a concern that leadership has a unique set of skills, knowledge, competencies, and attributes that need to be learned. The ensuing discussions focused on the questions and issues that revolve around those two aspects of leadership.

- How do we "create" and then support teacher leaders?
- When, in fact, does someone become a leader? Is it better to designate someone as a leader at the beginning or to wait until they've achieved some specified skill level?
- Is it reasonable to expect everyone to be a leader?
- Should leadership development be the specific goal of a professional development initiative, or should it be an element of any (and all) teacher enhancement initiatives?
- What roles can we expect teacher leaders to play?
- What would a curriculum for leadership look like?

Scaling Up

The discussion around scaling up started with the assumption that a worthwhile innovation had been developed and was operating successfully at one site. The participants then set the goal of identifying what factors needed to be considered in order to implement the innovation successfully at many, maybe 1,000, different sites. Some of the factors identified were

- quality control of the innovation across different sites;
- ensuring that those implementing the program understand and embrace its principles so that the program is not merely an "algorithmic manual" to follow;
- identifying what features of the innovation were essential, and what could be changed to adapt the innovation to a different site;
- ensuring that the users make informed choices, i.e., that there is a match between the program and the teachers' needs;
- buying into, and ownership of, the innovation at each implementation site;
- professional development as a key component of scale-up strategies; and
- consideration of the interaction among scaling up an innovation, the need for some uniformity across sites, and site-based management, with its implication of local control of decisions about such factors as curriculum.

Participants also considered the value of using a metaphor for thinking about scaling up, e.g., franchising, biological systems.

Evaluation and Assessment

The discussion around evaluation and assessment identified a number of key questions:

- How do you assess the quality of the content being provided for teachers?
- How do you effectively assess professional development strategies and models?
- How do you assess student outcomes and the relationship to professional development?
- How do you assess the systemic aspect of professional development: change within the system, the impact on teachers, and the impact on students?
- How do you isolate the variables that are really making the difference on a systemic change project?

As the group discussed the questions, they identified some elements necessary for the evaluation of any professional development initiative.

- Clear identification of the goals of the professional development before assessment of the outcomes. For example, are we looking for teachers to go back and implement a curriculum or to become leaders? The goals should drive both how and what is assessed.
- Periodic use of rubrics to assess teachers' progress on the "journey" that they on are on, as well as to assess the entire system.
- Looking at progress based on the stages that one moves through (e.g., using the Concerns-Based Adoption Model or Berliner's work).
- Embedding assessment in the professional development experiences.

Public Support

During the discussions around public support, it became apparent that other related critical issues have to be considered at the same time. For instance, there were the suggestions that generating public support is a critical role of leadership and that the results of evaluation can be used to garner support. Several questions that were raised included:

- There is a potential conflict between shared governance and state-driven programs of professional development in science and mathematics. Whose needs do you address first?
- How do we bring the school community and general public on board early so we don't have to convince them later as an afterthought?
- How do we get various stakeholders to accept what are commonly called "alternative measures" of student achievement?

Equity and Diversity

The discussions of this group covered a wide variety of issues, resulting in identification of a set of needs.

- Incorporate into professional development programs specific information about different groups and how they learn mathematics and science, so teachers can be more effective.
- Overcome the views of some teachers across the country, who don't believe that "all children can learn."
- Help teachers of mathematics and science understand that, rather than their content being "the truth," mathematics and science occur and are interpreted in a social context, and so their meaning to different learners will vary accordingly.
- Incorporate equitable practices and issues of equity into all professional development.
- Recognize multiple languages and a variety of viewpoints that represent different cultures as a strength for teachers to take advantage of.
- See equity as meeting the needs of all students, which may not mean providing equal opportunities, since some students have more needs than others.

Sustainability

Participants in this session delved into the numerous factors that may impact the sustainability of the effects of professional development efforts.

- People need to see that there is a connection between professional development and improved student learning, in order to sustain their efforts to change.
- Sustainability may be enhanced through building networks and infrastructures that support broader connections of school buildings to the rest of the world.
- Sustainability may be enhanced through developing more realistic long-term goals for professional development.
- Sustainability may only occur once we can ensure the development of a shared vision of what science and mathematics teaching are in this reform movement.
- Sustainability may depend on a broader view of what leaders look like, what their roles are, and what the structures should be that encourage development of leaders.
- Sustainability may require identification of multiple entry points in the system where professional development with multiple goals and multiple outcomes can be provided.
- We need to provide the public with short-term evidence of success in a manner that will not undermine long-term sustainable change.
- We need to focus more attention on mechanisms for affordably sustaining professional development: action research, study groups, professional development schools; restructuring schools to allow more time for collegiality, participatory decision making, and ongoing professional development; sharing strategies for public engagement about the benefits of change; and promoting staff involvement in generating long-term professional development plans for themselves.

Standards and Frameworks

Discussion of standards and frameworks centered more on the implications for schools, what science and mathematics should be taught and what teachers need to know, rather than on the implications for the design, nature, and practice of professional development.

One of the questions raised in this session was, What does it really mean to provide professional development from a "constructivist" perspective, as espoused by the standards? Many programs and initiatives embrace the standards and then try to "make people understand." The group discussed the idea that a constructivist approach would allow people to construct understanding before demanding that they implement new strategies or materials.

As the discussion continued, it became clear that many of the participants were struggling with the same issues and dilemmas.

- How do we engage teachers in their own learning about the standards? Engagement needs to be specifically addressed in professional development experiences.
- How much of the content do teachers really need to know in order to better teach mathematics and science, and what professional development opportunities are needed to help teachers acquire this content?
- How do we move from awareness of the standards to their implementation in professional development opportunities?
- Implementing the spirit of the standards may require that teachers have the opportunity to engage in inquiry learning over a long period of time with a great deal of reflection. How do we create adult learning environments that allow teachers to have that experience? Most professional development programs do not incorporate a view of teachers as adult learners, capable of self-direction.
- How should professional development deal with incongruency and incompatibility between the national standards and state frameworks when that occurs?

Reflections on the Design of the Forum

The Forum was designed with professional learning as a primary function and so afforded a unique opportunity to test the design framework of the NISE Professional Development team. Many elements of that design framework were used to design the Forum and were noted by participants and staff as contributing to the Forum's success.

- Formal and informal assessment of the needs of participants influenced the design. Data gathered before the Forum indicated that, among science and mathematics professional developers, there was consensus on principles of effective professional development. Consequently there was no explicit "teaching" of these principles, although they underlay all the sessions. The question, What is effective professional development? was not addressed directly, rather, How do I do it? How do I make it work in my setting?-the theme of Putting Knowledge into Action. The design framework and case discussions were used for this purpose.
- The design was based on a set of beliefs and knowledge shared by the designers, which included the importance of making and taking time to reflect, talk, question, and learn from the experience of others; valuing and giving voice to the expertise of all participants; celebrating and taking advantage of the collective power of the people gathered.

- Many opportunities were provided for participants to build a professional development community. These included structured small-group discussions (even break-out groups were subdivided), a longer lunch on Day 1, displays and materials available to all, a participant information booklet, and discussions of how to continue the conversations that the Forum began.
- The Forum used different structures and strategies for learning, including large group plenaries for information sharing, case discussions for small-group focused interactions, critical issues sessions for dialogue, prereading, and a question-answer session to follow up the reflections by Mark St. John and Iris Weiss.
- Continual reflection and revision were built in through frequent meetings of Forum presenters and facilitators, when they shared impressions and feedback, reviewed Day 1 evaluations, and critiqued and revised their plans for case discussions and critical issues sessions.

Some of the issues raised about Forum design for future consideration are:

- participation by more teachers, and in more active roles;
- more sharing of the thinking behind design;
- more specific plans for how to continue networking and learning as a community;
- having a better balance between "getting" knowledge about exemplary programs and sharing by all participants;
- more openness and willingness to critique each others' work,
- a third day to focus on strategies to address the issues identified;
- more structure to some of the critical issues sessions to offset the problem that, while the issues were ones the participants held in common, concerns about the issues were "all over the map"; and
- documentation of every session.

Quotable quote: I rode back on the Metro with six participants, and the discussions continued until the "end of the line."

Building a Learning Community

A major goal of the Forum was to make progress on building a learning community of professional developers. There are several reasons for doing so. The first is the recognition that the important work of professional development doesn't happen during a short-term meeting, such as the Forum. Just as we recognize that teachers need a community for continuing support, encouragement, and good ideas while they are teaching, so, too, do professional developers need a community to which they can turn when they need assistance.

A second reason for building a learning community is the power, insight, and breadth of ideas that flow from groups of people with different experiences but common purposes. Listening to others' perspectives and experiences both helps us become aware of a wider array of possibilities and facilitates our examining our own assumptions and practices. The communal process can

lead to self-empowerment, and the communal products can attain a new level of insight and sophistication. This is, of course, reminiscent of the experience of students who learn about science and mathematics, and teachers who learn about teaching in similar ways.

Identifying the need for a learning community is one thing: making it happen is an entirely different matter. While it is obvious that the Forum, as a one-time, special, national gathering, has played an important part in developing a learning community, it cannot be the only type of activity in which people interact with one another about professional development. There is a need for more frequent, regular contact that can occur at conferences already attended by professional developers, as well as through informal contact with colleagues.

By definition meetings are face-to-face. While this is important for a variety of reasons, there is an increasing list of options for communicating with others who are not in the same place. These include asynchronous forms of communication such as mail, e-mail, and fax machines, and synchronous forms such as telephones, video-conferencing, and computer-based chat lines. We clearly need to investigate these various possibilities and identify the characteristics they have that either hinder or facilitate effective communication within a learning community.

The NISE Professional Development team is exploring some specific ways to continue our interactions and will notify Forum participants when each is ready.

- As part of the NISE web site, we will be setting up a page on Professional Development with relevant documents for review and feedback. These will include sections of the book we are writing.
- We are exploring connections with TEECH (Teacher Enhancement Electronic Communications Hall) to use their network to expand ours and to sponsor discussions around key issues with their e-mail.
- We are exploring the possibility of using TappedIn (Teacher Professional Development Institute), a different format for electronic communication currently under development by SRI, because it can handle same-time conversations, sharing of resources, and the building of common documents (among other things).
- We intend to sponsor extended miniforums at the National Science Teachers Association (NSTA) regional and national conferences next year to continue the conversations begun at the Forum and to explore other opportunities to work with National Council of Teachers of Mathematics (NCTM) and the National Staff Development Council (NSDC), who also provided cases for discussion at the Forum.

One can point to events such as the Forum where professional development is a primary focus and identify structures and techniques for facilitating communication about professional development. However, the heart of the learning community is the people who are its members, and the actions that they take in contacting others, establishing conversations, and sharing ideas and resources provide effective professional development learning opportunities for their colleagues. Being in community does not mean physically being in the presence of others (as at the Forum); it is a state of mind that leads you to communicate with others, regardless of the physical isolation of your circumstances.

Appendix A
Forum Agenda

First Annual Forum - National Institute for Science Education

March 18-19, 1996
Holiday Inn, Rosslyn Westpark Hotel, Rosslyn, VA

Professional Development for Science and Mathematics Education:
Putting Knowledge into Action

Final Agenda

Sunday, March 17

4:00-7:00 pm	Early registration, Poster set-up	2nd floor Promenade

Monday, March 18

7:30-8:30 am	Registration, Poster Set-up, Continental Breakfast **Sponsored by Delta Education**	2nd floor Promenade
8:30-10:15 am	Opening Plenary	Ballroom
	Welcomes	
	National Science Foundation	*Anne Peterson*
	National Council of Teachers of Mathematics	*Jack Price*
	National Science Teachers Association	*JoAnne Vasquez*
	National Staff Development Council	*Kathryn Blumsack*
	Overview of the NISE	*Andy Porter, Denice Denton*
	The Strategic Importance of Professional Development in Systemic Reform	*Luther Williams*
	Professional Development as Decision Making: A Model for Designing Professional Learning Opportunities	*Susan Loucks-Horsley, Peter Hewson*
10:15-10-30	Break	2nd floor Promenade
10:30-12:00 am	Concurrent Session 1: Professional Development Case Discussions Participants should elect sessions they indicated in their agenda questionnaire, if at all possible.	See attached matrix for cases, rooms
12.00-1:30 pm	Box Lunch **Sponsored by Duracell Batteries**	2nd floor Promenade
	Posters/Displays/Networking	Ballroom
1:30-3:00 pm	Concurrent Session 2: Professional Development Case Discussions Participants should elect sessions they indicated in their agenda questionnaire, if at all possible.	See attached matrix for cases, rooms
3:00-3: 15 pm	Break	2nd floor Promenade
3:15-4:45 pm	Concurrent Session 3: Critical Issues in Professional Development Participants should see name badge for assignments.	See attached matrix for cases, rooms

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4:45-5:00 pm	Mid-Conference Evaluation	*Susan Millar* Same rooms as Concurrent Session 3
5:00-6:00 pm	Remove Posters. Handouts may be left through Tuesday.	

Tuesday, March 19

7:30-8:30 pm	Continental Breakfast **Sponsored by Toyota**	2nd floor Promenade
8:30-9:00 am	Plenary **Session 2**	Ballroom
	Observations, Challenging Questions for Day 2	*Iris Weiss, Mark St. John*
9:00-10:00 am	**Plenary Session 3**	**Ballroom**
	Major **NISE** Projects	. *Daryl Chubin*
	Policy Analysis of Systemic Reform	*Andy Porter, Peirce Hammond*
	College Level One	*Art Ellis, Robert Watson*
	Strategies for Evaluating Systemic Reform	*Norman Webb, Larry Suter*
	Studies of Interdisciplinary Communication	*Sharon Deny*
	Public and Professional Communications	*Susan Trebach, Senta Raizen*
10:00-10:15 am	Break	**2nd floor Promenade**
10:15-11:30 am	**Concurrent Session** 4: Professional Development Cases; and other major **NISE** projects **Participants should elect sessions they indicated in their agenda questionnaire, if at all possible.**	**See attached matrix for cases, rooms**
11:45-12:45	**Lunch and Networking** **Sponsored by Duracell**	2nd floor Promenade Tables **available in ballroom and breakout rooms**
12:45-1:15	**Plenary Session 4**	*Margaret Cozzens,* NSF
	Critical Role of Professional Development in Science and Mathematics Reform	*Bruce Alberts, President NAS*
1:30-2:45	**Concurrent Session** 5: Professional Development Cases; and other major NISE projects **Participants should elect sessions they indicated in their agenda questionnaire, if at all possible.**	See attached matrix for cases, rooms
2:45-3:00	Break	**2nd floor Promenade**
3:00-4:00	**Concurrent Session** 6: Critical Issues (cont'd from **Concurrent** Session 3) **Participants should see name badge for assignment**	**See attached matrix for sessions, rooms**
4:00-4:30	**Closing Plenary**	Ballroom
	Summary of Critical Issues Observations and Challenges for the **Future**	*Susan Loucks-Horsley* *Iris Weiss, Mark St. John*

Some plenary sessions will be made available in audio and text forms by project TEECH at **http://hub.terc.edu/teech.html.**
They also will be accessible through the **NISE** web site at **http://www.wcer.wisc.edu/nise.**

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